CLAIMS

1. A method for transmitting data packets from an output queue to a wireless mobile device across a forward radio frequency link of an associated spread-spectrum communications system, the method comprising the steps of:

a) determining a weighted average level of the output queue while transmitting a data packet at a first data rate;

b) transmitting a subsequent data packet at a second data rate that is lower than the first data rate when the weighted average level of the output queue is below a low threshold value; and

c) transmitting a subsequent data packet at a third data rate that is higher than the first data rate when the weighted average level of the output queue is equal to or above a high threshold value.

2. The method of claim 1, wherein step a) comprises the step of:

d) determining the weighted average level according to the equation $q_{avg} = (a)q_{avg} + (1-a)q_n$, where a is a weighting factor, q_n is a present level of the output queue, and q_{avg} is the weighted average level of the output queue.

3. The method of claim 1, wherein step b) comprises the steps of:

d) determining an internal data rate adjustment value according to the equation $r_{int} = r^{opt}_n - b$, where r^{opt}_n is the first data rate, and b is a constant with a value less than the first data rate; and

e) determining the second data rate according to the equation $r^{opt}_{n+1} = (1-f)r^{opt}_n + (f)r_{int}$, where f is a weighting factor, r^{opt}_n is the first data rate, r_{int} is the internal data rate adjustment value, and r^{opt}_{n+1} is the second data rate.

4. The method of claim 3, wherein step c) comprises the steps of:

f) determining the internal data rate adjustment value according to the equation $r_{int} = (d)r^{opt}_n$, where d is a constant that is greater than one, but less than a ratio of a maximum achievable data rate to the first data rate, and r^{opt}_n is the first data rate; and

g) determining the third data rate according to the equation $r^{opt}_{n+1} = (1-f)r^{opt}_n + (f)r_{int}$, where f is a weighting factor, r^{opt}_n is the first data rate, r_{int} is the internal data rate adjustment value, and r^{opt}_{n+1} is the third data rate.

5. The method of claim 1, wherein step c) comprises the steps of:

d) determining an internal data rate adjustment value according to the equation $r_{int} = (d)r^{opt}_n$, where d is a constant that is greater than one, but less than a ratio of a maximum achievable data rate to the first data rate, and r^{opt}_n is the first data rate; and

e) determining the third data rate according to the equation $r^{opt}_{n+1} = (1-f)r^{opt}_n + (f)r_{int}$, where f is a weighting factor, r^{opt}_n is the first data rate, r_{int} is the internal data rate adjustment value, and r^{opt}_{n+1} is the third data rate.

6. The method of claim 1, further comprising the steps of:

d) before step a), determining a transport protocol of data packets received from an upstream component of the associated spread-spectrum communications system; and

e) selecting a parameter set from a plurality of predetermined parameter sets based on the transport protocol, each parameter set containing parameter values for determining one or more of the weighted average level of the output queue, the second data rate, and the third data rate.

7. The method of claim 1, further comprising the step of:

d) determining an input data rate for data packets received from an upstream component of the associated spread-spectrum communications system;

wherein step b) comprises the step of:

e) determining the second data rate based on the input data rate; and

wherein step c) comprises the step of:

f) determining the third data rate based on the input data rate.

8. The method of claim 1, further comprising the step of:

d) determining an input data rate for data packets received from an upstream component of the associated spread-spectrum communications system; and

wherein step b) comprises the steps of:

e) determining an internal data rate adjustment value according to the equation $r_{int} = s_n - b$, where s_n is the input data rate, and b is a constant with a value less than the first data rate; and

f) determining the second data rate according to the equation $r^{opt}_{n+1} = (1-f)r^{opt}_n + (f)r_{int}$, where f is a weighting factor, r^{opt}_n is the first data rate, r_{int} is the internal data rate adjustment value, and r^{opt}_{n+1} is the second data rate.

9. The method of claim 1, further comprising the step of:

d) determining an input data rate for data packets received from an upstream component of the associated spread-spectrum communications system; and

wherein step c) comprises the steps of:

e) determining an internal data rate adjustment value according to the equation $r_{int} = s_n(d)$, where d is a constant that is greater than one, but less than a ratio of a maximum achievable data rate to the first data rate, and s_n is the input data rate; and

f) determining the third data rate according to the equation $r^{opt}_{n+1} = (1-f)r^{opt}_n + (f)r_{int}$, where f is a weighting factor, r^{opt}_n is the first data rate, r_{int} is the internal data rate adjustment value, and r^{opt}_{n+1} is the third data rate.

10. An apparatus associated with a wireless infrastructure that optimizes a rate of transmitting forward link data to a wireless mobile device across a forward radio frequency link, the apparatus comprising:

an output queue that stores forward link data to be transmitted to the wireless mobile device; and

a processor programmed to adjust a rate of forward link data transmission based on a weighted average queue value for the output queue.

11. The apparatus of claim 10, wherein the processor is further programmed to determine the weighted average queue value according to the equation $q_{avg} = (a)q_{avg} + (1-a)q_n$, where a is a weighting factor, q_n is a present level of the output queue, and q_{avg} is the weighted average queue value.

12. The apparatus of claim 10, wherein the processor is further programmed to decrease the rate of forward link data transmission from a first data rate to a second data rate when the weighted average queue value is below a first predetermined threshold, and to increase the rate of forward link data transmission from the first data rate to a third data rate when the weighted average queue value is equal to or above a second predetermined threshold.

13. The apparatus of claim 12, wherein the processor is further programmed to determine an internal data rate adjustment value according to the equation $r_{int} = r^{opt}{}_n - b$, where $r^{opt}{}_n$ is the first data rate, and b is a constant with a value less than the first data rate; and to determine the second data rate according to the equation $r^{opt}{}_{n+1} = (1-f)r^{opt}{}_n + (f)r_{int}$, where f is a weighting factor, $r^{opt}{}_n$ is the first data rate, r_{int} is the internal data rate adjustment value, and $r^{opt}{}_{n+1}$ is the second data rate.

14. The apparatus of claim 12, wherein the processor is further programmed to determine an internal data rate adjustment value according to the equation $r_{int} = (d)r^{opt}_{n}$, where d is a constant that is greater than one, but less than a ratio of a maximum achievable data rate to the first data rate, and r^{opt}_{n} is the first data rate; and to determine the third data rate according to the equation $r^{opt}_{n+1} = (1\text{-}f)r^{opt}_{n} + (f)r_{int}$, where f is a weighting factor, r^{opt}_{n} is the first data rate, r_{int} is the internal data rate adjustment value, and r^{opt}_{n+1} is the third data rate.

15. The apparatus of claim 10, wherein the apparatus further comprises an input buffer, and the processor is further programmed to adjust the rate of forward link data transmission based on a particular transport protocol of the forward link data received at the input buffer.

16. The apparatus of claim 10, wherein the apparatus further comprises an input buffer, and the processor is further programmed to adjust the rate of forward link data transmission based also on an input data rate of the forward link data received at the input buffer.

17. The apparatus of claim 16, wherein the processor is further programmed to determine an internal data rate adjustment value according to the equation $r_{int} = s_n - b$, where s_n is the input data rate, and b is a constant with a value less than the input data rate; and to determine the rate of forward link data transmission according to the equation $r^{opt}_{n+1} = (1\text{-}f)r^{opt}_{n} + (f)r_{int}$, where f is a weighting factor, r^{opt}_{n} is a first data rate for forward link data transmission, r_{int} is the internal data rate adjustment value, and r^{opt}_{n+1} is a second data rate for forward link data transmission.

18. The apparatus of claim 16, wherein the processor is further programmed to determine an internal data rate adjustment value according to the equation $r_{int} = s_n(d)$, where d is a constant that is greater than one, but less than a ratio of a maximum achievable data rate to the input data rate, and s_n is the input data rate; and to determine the rate of forward link data transmission according to the equation $r^{opt}_{n+1} = (1-f)r^{opt}_n + (f)r_{int}$, where f is a weighting factor, r^{opt}_n is a first data rate for forward link data transmission, r_{int} is the internal data rate adjustment value, and r^{opt}_{n+1} is a second data rate for forward link data transmission.

19. A method for data transmission within a spread-spectrum communications system, the method comprising the steps of:

a) determining that data should be transmitted by a wireless infrastructure to a wireless mobile device via a forward link;

b) determining a current size of a queue for the forward link data transmission;

c) determining a weighted average size of the queue during the forward link data transmission;

d) decreasing a data rate for the forward link data transmission when the weighted average size of the queue is below a low threshold value, otherwise comparing the weighted average size of the queue to a high threshold value;

e) increasing the data rate for the forward link data transmission when the weighted average size of the queue is greater than or equal to the high threshold value, otherwise leaving the data rate for the forward link data transmission unchanged; and

f) transmitting data in packets to the wireless mobile device via the forward link at the forward link data transmission rate.

20. The method of claim 19, wherein step c) comprises the step of determining a new average size of the queue during the forward link data transmission according to the equation $q_{avg} = (a)q_{avg} + (1-a)q_n$, where a is a weighting factor, q_n is the current size of the queue, and q_{avg} is the weighted average size of the queue.